



STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1263 S. Stewart Street
Carson City, Nevada 89712

DOCKET FILE COPY ORIGINAL

BOB MILLER, Governor

December 16, 1996

TOM STEPHENS, P.E., Director

In Reply Refer to:

Office of the Secretary,
Federal Communications Commission
Washington D.C. 20554

RECEIVED

DEC 18 1996

FCC MAIL ROOM

Dear Sir,

Please find attached five copies of reply comments to FCC Docket 96-86 prepared by the Nevada Department of Transportation.

Should additional information regarding the Departments comments be required, please contact me at (702) 888-788.

Sincerely,


Richard Sheldrew
Telecommunications Manager

cc: Roger Grable
Assistant Director

No. of Copies rec'd
List ABCDE

024
WT

RECEIVED
DEC 18 1996
FCC MAIL ROOM

Before the
FEDERAL COMMUNICATIONS COMMISSION

Washington, D. C. 20554

**REPLY COMMENTS TO FEDERAL COMMUNICATIONS
COMMISSION NPRM DOCKET NO. 96-86**

**The Development of Operational, Technical, and Spectrum Requirements
for meeting Federal, State, and Local Public Safety Agency Communications Requirements
through the year 2010**

Nevada Department of Transportation
1263 South Stewart St.
Carson City, Nevada 89712
Telecommunications Div.

December 16, 1996

CONTENTS

INTRODUCTION	1
COMMENT SUMMARY	3
INTEROPERABILITY ISSUES	3
OPERATIONAL ISSUES	5
SPECTRUM ISSUES	6
TECHNOLOGIES	8
APCO 25	9
FREQUENCY COORDINATION	10

INTRODUCTION

The Nevada Department of Transportation is a governmental agency which falls under Highway Maintenance Radio Service described under Docket 96-86, Section III. Background, paragraph 8. NDOT agrees with expanded comments submitted by the American Association of State Highway and Transportation Officials, (AASHTO) regarding the role of State Transportation Departments throughout the Nation. NDOT's viewpoint is that Transportation Departments will become the largest user of electronic technologies in governments due to the implementation of Intelligent Transportation Systems. These technologies are communications intensive.

NDOT has reviewed NPRM 96-86, and agrees that issues identified by the Commission, under IV Discussion, must be addressed and resolved. It is also noted that differing viewpoints from parties will make it difficult for the Commission to produce a product agreeable to all which must combine the myriad operational, technical and spectrum viewpoints into a strategic plan for government for the next 14 years. Regarding these issues, it is NDOT's viewpoint that just as economics has determined the present level of governmental communications systems, economics will also dictate the future of governmental telecommunications systems. The capability and capacity of present mobile radios systems which support public safety entities range from substandard to exceptional. In lieu of more spectrum, and more money, the solution to many of the issues and problems might be in educating government that other methods of achieving better communications may be available.

The Nevada Department of Transportation, faced with many of the issues identified in Docket 96-86, has implemented a program plan to develop a shared regional 800 MHz communication system based on partnerships with other state agencies, local governments, Federal agencies, and utilities. To this extent, the FCC has approved a waiver allowing the sharing of frequencies between the partnership. To date, the results of this partnership have resulted in:

1. Spectrum efficiency
2. Increased interoperability
3. Economies of Scale
4. Increased system capability and capacity

However, as noted by the FCC in the approval of the Nevada waiver, the Associated Public Communications Officers, Inc (APCO) filed opposing arguments to the Nevada Partnership effort and continues to oppose the Departments efforts to implement this system. This action has required the Department to seek assistance from the FCC to resolve frequency coordination issues. In addition to this opposition, the Department has also been required to defend its position of non support for APCO 25. Even with all of these issues, many of the Commissions recommended approaches to resolve the issues identified in Doc. 96-86 have already been implemented by NDOT as a result of the Nevada waiver.

In summary, many FCC recommended solutions which have been implemented by NDOT have resolved many of the issues identified in Doc. 96-86. The Department is providing comments to encourage and support the Commission in proceeding and approving staff recommendations in this Docket.

COMMENT SUMMARY

It is the Departments viewpoint that the majority of the Commissions recommended approaches in Docket 96-86 are in the best interest of government and/or public safety. In particular, the implementation of shared regional systems may be the best solution to meeting both the Commission's objectives and the needs of the citizens. In review of draft comments from various public safety organizations, it is noted that some commentors oppose this method and infer differences between services and systems of public service providers. NDOT does not agree with these comments and sees this type of viewpoint as being detrimental to the resolution of issues identified by the Commission.

The Nevada Department of Transportation provides comments relative to FCC Docket No. 96-86 in the following areas:

- A. Interoperability
Eligibles/Public Safety Definition
- B. Operational Issues
- C. Spectrum Issues
- D. Technology
- E. APCO-25
- F. Frequency Coordination

COMMENTS

A. Interoperability Issues

Under this discussion heading, the Commission identifies two issues:

1. *Public Safety Definition*
 2. *Interoperability issues*
1. *Public Safety Definition*

While these two issues interrelate, NDOT sees the Public Safety Definition as a stand alone issue. Pertaining to issues surrounding the definition of public safety, NDOT fully supports a broader definition which would allow public service providers such as utilities to be included. This broader range of users when coupled with advanced trunking technologies will increase the probability of shared systems being implemented. While not specifically addressed in this docket, the Commission requests comments under spectrum alternatives regarding the implementation of common shared systems. NDOT sees shared systems as a critical element to addressing and resolving interoperability, operational, technical, spectrum, and funding issues facing government.

At the same time, a shared system which supports public service providers ranging from law enforcement to utilities makes the identification of differing levels of service providers a moot issue.

A review of radio usage by these providers reduces to two types of occurrences;

1. The radio system is used for normal conversation where information is not time sensitive.
2. The radio system is used for urgent conversation where information is time sensitive and impacts the user or person for which service is being provided for.

The difference between users defined by PSWAC as public safety and public service is that there is a higher probability that users defined as public safety, will use the radio system for urgent conversation. However, it is incorrect to say that a user defined as public service doesn't need the same level of urgent communications when a need arises.

2. *Interoperability Issues*

NDOT agrees with FCC comments regarding interoperability issues as they pertain to definitions, needs, and options. Lengthy discussions have resulted from the need of two or more entities who must communicate with each other. Elements of interoperability include technologies, spectrum and the level of interoperability desired. The Department's position is:

1. Interoperability is desired and needed.
2. It may be needed between two or more entities which in emergencies include major utilities.
3. That maximum interoperability and cost benefit can best be achieved by a shared system[1] which has the technology to allow all levels of interoperability with any limitations on the level of interoperability being an operational decision.
4. When multiple systems are implemented, the issue reduces to economics. The level of interoperability becomes a function of cost required to procure the necessary technical interfaces to connect the multiple systems together.

The NDOT shared system has resulted in achieving complete interoperability between its users, and has done so in a cost and spectrum efficient manner. It is noted that many comments discuss the need for interoperability under its subject category but then restrict the ability to achieve interoperability by classifying different user services or simply oppose the inclusion of users in a service category for which interoperability is desired.

It is NDOT's conclusion that the FCC should allow and encourage governmental agencies of all categories and utilities which have a direct impact on the welfare of the citizens (i.e. the greater public safety and public service communities) to share both common systems and frequencies in order to maximize interoperability and cost savings while increasing system capacity and capability.

NOTE 1 Refer to Nevada Department of Transportation "A Case Study Summary - Interoperability as a Cost benefit of New Technologies and Systems"

B. Operational Issues

The Commission seeks comments regarding operational issues pertaining to service features and system requirements. As mentioned in the introduction to these comments, it is NDOT's viewpoint that Transportation Departments will become one of the largest users of electronic technologies due to the implementation of Intelligent Transportation Systems. The applications performed by these technologies include at a minimum the service features identified by the Commissions staff in paragraph 48 of Docket 96-86.

NDOT mobile radio requirements are similar if not identical to every other mobile user in either the private or governmental radio services. In summary, there exists the requirement for the system to:

- * provide communications to, from, and between vehicles, people and a control or dispatch point, and do so throughout its entire operational area;
- * provide the capability to support either voice or data transmission;
- * achieve this communications without delay;
- * be able to intercommunicate with other entities when required;
- * and use cost efficient technologies or systems to achieve all the above.

The net of these requirements results in productivity gain which reduces to better and improved service to the public.

The types of applications used on a system will vary between the users, however the following can be stated as follows:

As more and more applications are developed, the demand for wireless services such as mobile radio, cellular, telemetry, PCS, etc., will increase and the costs associated with using or implementing these technologies will become a major decision factor that determines the level of communications an agency receives or can obtain. As shown by comments to this NOI, pages and pages of applications using buzz words such as 911 CAD, NCIC 2000, and ITS have been listed as operational needs. When coupled with the competition internal within governments that fight for allocations from governmental tax revenues, the objective of achieving a good communications system becomes a difficult challenge. Knowing a finite spectrum exists which must be divided between these services to support the listed applications, the resolution to meeting the future requirements of public safety should not focus necessarily on spectrum issues, but instead should focus on meeting the requirements in the most cost effective manner. Radio frequencies are simply the medium which supports the transmission of a government's applications. Unfortunately, the resolution of the above issues are further complicated by special interest, multiple viewpoints, and in many cases the resistance to change by individuals within governments. This precludes alternative paradigms to present methods from being implemented that in many cases would enhance the telecommunications capabilities for public safety.

It is the Department's conclusion that operational requirements which require the implementation of electronic applications requiring radio spectrum support as in the past will continue to be based principally on economics. If an agency's requirements mentioned above are met, then decisions regarding usage of either commercial/private or governmental owned systems can reduce to an economic decisions of achieving the desired applications in the most cost effective way.

C. Spectrum Issues

Docket 96-86 requests comments regarding spectrum allocations options. Alternatives include:

1. Allocation of additional public safety spectrum
2. Reallocation of spectrum currently assigned to Federal Government
3. Requirement of system sharing
4. Use of spectrum-efficient system
5. Use of commercial wireless services
6. Promotion of more efficient use of the spectrum allocated for public safety use

As mentioned in the introduction of this report, the Nevada Department of Transportation in cooperation with several other local, state, Federal agencies, and major utilities requested and received a waiver to share frequencies and implement a common shared system. We therefore can speak to issues 3, 4, and 6 and provide our results to date. By sharing or partnering on the implementation of a regional statewide system, and using proper frequency reuse with trunking technologies, a regional system is able to achieve:

- a. The individual cost of implementing a system to the department and users is reduced. This cost savings reduces the burden on the taxpayer and rate payer who is one in the same. This has resulted in the partnership achieving a state of the art system at a minimum cost.
- b. The level of interoperability between the users is maximized as compared to separate systems and is accomplished as less cost.
- c. With proper frequency reuse, the partnership will require fewer frequencies as compared to each entity implementing a separate system statewide
- d. With proper frequency reuse and trunking technologies, greater channel availability and resultant throughput increases will be available for each user, as compared to a separate individual systems. This applies to both urban and rural environments.
- e. The costs associated with development of support infrastructures, such as communications facilities and microwave systems, have been reduced.
- f. The Nevada shared system has proven that 800 MHZ trunking systems are economically and technically feasible in both urban and rural areas and that these systems provide the intelligence and ability to be expanded to provide the needed bandwidth for future applications as identified by PSWAC.

If there is a limited amount of spectrum to meet the wireless need of both government and industry, and given that greater bandwidths or better data compression techniques will be required to support future wireless applications, it is the Commission's responsibility to ensure that better spectrum utilization occurs. Therefore, both government and industry alike should be required to maximize their usage of both the frequencies and the technologies which support the frequencies.

An obvious method of increasing frequency utilization is requiring smaller service areas. In review of issues surrounding the ultimate spectrum or frequency band for public safety, we know that the spectrum is a finite resource. Using the existing guidelines established by the FCC or assuming an average service area with a radius of 20 miles, the impact of propagation differences between bands become smaller and therefore less of a decision factor. NDOT agrees with the Commission that smaller coverage areas should be required to increase frequency reutilization. It is ironic that some states complain to the FCC regarding VHF systems on high mountains, which impact large geographical areas beyond the intended service areas, and then complain when it is recommended to require these systems be engineered only for a given service area to allow frequency reuse. Contrary to several commentors, NDOT's experience with their regional system, and a review of the cellular industry, shows that higher frequencies such as 800 MHz work in both rural and urban environments. When coupled with smaller service areas, frequencies throughout the band can be utilized for both urban and wide area/regional systems. There also appears to be confusion among commentors that the information capacity or density of a system is related to the frequency band, its geographical usage, and if it is a rural or urban environment. This is incorrect. The capacity or density of the system is not a function of frequency band, but is a function of applications support. An example could be a system using TDMA modulation supporting a large number of voice units in an urban area as compared using a TDMA system of equal capacity serving data applications requiring a high throughput in a rural area.

In review of Alternative 5, which recommends usage of commercial services, it is noted that a large number of public safety agencies stated that they must control and have autonomy over their systems. Given that constant changes in telecommunications methods and technologies are occurring before equipment life cycles end, this type of thinking could actually hinder the advancement of public safety telecommunications. If a system can meet the requirements of public safety and government, as mentioned under operational issues, then the issue of using a governmental owned or commercial service reduces to economics.

One other reason to consider Alternative 1 is to increase the ability for interoperability to occur since all users would be in the same frequency band. In theory, this would correct many of the problems associated with interoperability. However there are several logistic hurdles which reduce to costs and funding with changing multimillion dollar infrastructures. Given the inefficient nature of government to implement projects or systems, along with delays which are caused by funding/budgeting issues, and the fact that many systems have been or are planned to be implemented during the course of this docket, the following questions are raised.

1. If additional spectrum were provided, will government funding priorities shift or change to take advantage of new spectrum, knowing that they must make communications a priority and redirect or request additional tax monies to implement new systems in lieu of other projects?

2. If funding becomes available and assuming that systems can be implemented by 2005, are the technologies being proposed such as APCO 25 adequate to meet both the Commissions objectives and governments requirements?
3. If spectrum were developed, and as shown by the failure of APCO 25, does government have the same incentive to develop and deploy spectrum efficient technologies as compare to private sector which has both funding for research and incentive.

In review of present government and political structures coupled with resistance to increase taxes, any one of the above issues would be a long and difficult undertaking. It would also seem that the alternatives of providing technologies which link different bands together combined with multi mode radios would be equally effective.

It is the Department's conclusion that since the spectrum is a finite resource, that additional allocations identified under alternatives 1 & 2 should not occur until public safety can prove that alternatives 3,4,5, and 6, are incapable of providing the required communications for public safety and or increased spectrum utilization. The Department also notes that if the logistic hurdles required to transition to a common frequency band require extensive time, interoperability still will not be achieved. As will be discussed under technologies, those who implement spectral efficient technologies or shared systems should be rewarded while those who do not employ spectral efficient methods should be penalized. As will be discussed under technologies, and given the track record of government and government associations which attempt to address spectrum and supporting technology issues, it is the Departments viewpoint that if new spectrum is allocated, and knowing that these allocations will deplete a large percentage of the remaining spectrum resource, industry is in a better position to maximize its usage and ensure that spectrum efficient technologies are developed and deployed.

D. TECHNOLOGIES

In review of the FCC's goals and public safety's requirements, the relationship and objectives of technologies which transmit radio waves or use spectrum are:

1. To provide the means to support applications which satisfy government's operational requirements in a cost effective manner, and;
2. Accomplish these requirements using the smallest amount of spectrum as possible, and;
3. Allow systems to communicate with each other for purposes of interoperability.

These objectives must be coupled with:

1. Physical laws which govern wireless information transfer;
2. The need to ensure technologies sold to governments are proven; and
3. The requirement to ensure that investments of millions of dollars result in systems with life cycles of at least 10 years before reinvestment must occur.

The Commission has limited options. It must promote the most spectrum efficient technologies which are proven and ensure that operational methods such as shared systems are employed. Since the Department's differences with APCO 25 are technology related, the rest of this discussion and recommendation will also address APCO 25 related issues.

E. APCO-25

The Commission requested comments regarding technologies which when implemented would support increased public safety requirements and do so in spectrum efficient ways. The Commission has identified four technologies which are currently available to support public safety. They include CDMA, TDMA, FDMA, ACSSB. Of these technologies, the Department is not aware of products which use CDMA or ACSSB technologies and operate on frequencies eligible to public safety in the 806-824 MHz band. We conclude that they are more spectrally efficient than older FM modulation techniques and if made available at 800 MHz or conversely, if the Department is required to relocate to another frequency band supported by these technologies, they would be considered.

This reduces to TDMA and FDMA as available options for public safety. As shown by the industry, both TDMA and FDMA are proven technologies. Contrary to comments regarding TDMA from some public safety entities, industry would not invest millions of dollars for research and development and deploy this technology if it is incapable of meeting mobile radio requirements. It is also noted that TDMA was selected as the TETRA standard for European public safety entities, therefore, it would appear that those who oppose TDMA for public safety may not fully understand the issues regarding these modulation techniques.

As mentioned earlier, the Department has been criticized for not supporting the APCO 25 project. In review of an incomplete APCO standards process, the major reason for this non support is that NDOT does not believe that FDMA technologies adopted by APCO will meet our future requirements which will be bandwidth intensive. In lieu of in-depth technical discussion of TDMA and FDMA, which have already been beaten to death in the public safety community, we conclude the following:

It is the Department's viewpoint that if NDOT changes from analog to digital technologies, and given future applications which require high speed data support, TDMA technology has a greater probability to provide for these needs. A major reason for this decision is the ability of present TDMA techniques to provide bandwidth on demand or dynamically allocate bandwidth based on need. When this type of technology is deployed as part of a shared system with other users, the probability of shared bandwidth for both narrowband and wideband applications is both spectrally efficient and cost beneficial to all users.

As for APCO's attempt at standards setting, APCO 25 is the perfect case study where special interests, a lack of knowledge regarding how industry works, and as shown by recommendations, an apparent lack of technical knowledge results in decisions which may not truly be in the interest of public safety.

We note the following:

1. In a technical publication by APCO 25¹ regarding a common air interface, the author states, "Each RF-subsystem manufacturer, however, may augment the basic feature set to include new features which are supported only on that manufacturer's mobiles and portables."

Regarding this issue, we observe that APCO continues to request additional spectrum from the FCC to support public safety. These requests are justified based on interoperability, and the requirement to support new features and applications. We then note that APCO standards processes preclude these augmented features from working on all industry radio's, and to become proprietary to a particular manufacturers products. This is not in the best interest of either industry, the user, or the Commissions goals which is to achieve maximum application from any product for public safety and do so in a spectrum efficient manner.

2. There are three major vendors who provide the majority of equipment for public safety. APCO has adopted a technology that is proprietary to one of the vendors. The results of this decision are that multiple products are not available to the public safety user and if there were, because of issue 1, they would not be fully compatible.

Regarding this issue, and as shown by the industry, adopting standards in this method has not worked.

3. APCO claims that APCO 25 is the equivalent of the European standard TETRA.² The core of this article reduces down to the biggest difference between the viewpoint of the Department and several manufacturers, and APCO's adoption of a technology.

The common elements which drove these two standards and are major subjects in PSWAC and Docket 96-86 are:

- a. A lack of radio spectrum or channels.
- b. A need to meet additional services such as data transfer, vehicle location information, video transmission, etc..

The difference is that APCO adopted FDMA technology and TETRA adopted TDMA which is the Departments preferred choice.

It should be noted that practically every argument used by APCO-25 to support its choice of FDMA and supporting technology, which is owned by one manufacturer, were the same arguments used by TETRA which resulted in the choice of TDMA and technologies available under ETSI to the entire industry.

¹ Article by Richard A. Comroe, APCO 25-Demonstrating the Power, Potential and Benefit of a Standard, August 1996 APCO Bulletin.

² Article by Phil Godfrey, TETRA Digital Radio Core Standard is Completed, August 1996 APCO Bulletin.

In review of APCO 25, we conclude the following;

- a. TDMA technologies are more spectrally efficient than APCO's recommendations of FDMA technologies.*
- b. TDMA technologies will work in both a urban and rural environment.*
- c. The adoption of a technology whose property rights are controlled by one manufacturer is not in the best interest of the public safety user and will not provide for a competitive environment.*
- d. We do not agree with nor do we understand how APCO-25 reached its conclusions. However, we note that allowing associations such as APCO, which are comprised mainly of dispatchers and non technical managers, to make decisions regarding technical standards has not worked. [When making decisions regarding complex radio technologies and subsequent impacts, a thorough understanding of technical differences along with forces which drive industry are required.]*
- e. The Department agrees with comments by the commission's staff that it is the FCC's responsibility and that they may be in a better position to best address many of the issues noted in Docket 96-86. When coupled with APCO's opposition to the Nevada Shared System, which is showing alternative methods of achieving better communications through sharing, along with better spectrum utilization, we cannot recommend placing the decision processes regarding public safety issues identified in Docket 96-86 outside the jurisdiction of the Commission.*
- f. If the FCC continues to allow associations or users to develop standards, then they may wish to review the TETRA process and develop a set of guidelines regarding how standards will be developed. This step may prevent the next standards process from failing as APCO 25 has done.*

E. Frequency Coordination

In review of other issues, Docket 96-86 requests comments regarding frequency coordination and if the changes should occur to the present process. There are recommendations in Docket 96-86 which if implemented will significantly change the definition of Public Safety. This change will impact the coordination processes. Options available to the FCC include:

- 1. Keep existing structures;
- 2. Provide a single or multiple point(s) of contact which can provide any required frequency coordination service for a user or users through representative organizations or privatized services.

As shown by the Nevada shared system, new technologies can provide for shared systems and can support multiple public safety disciplines along with other disciplines such as utilities. This results in several service categories sharing the same frequencies. Understanding that the present structure was established to meet coordination requirements based on individual frequency groups for each service and given current recommendations which encourage shared systems between multiple services, the present method must be reviewed and revised. The issue reduces to:

- a. Establishing a single point of coordination for frequencies which are shared between multiple services;
- or
- b. Allowing existing representative coordination bodies to coordinate frequencies presently coordinated under a single organization which are shared between multiple service disciplines.

It is also understood that the role of a coordination service is:

- 1. Be representative of those users applying for frequencies;
- 2. Offer non discriminatory coordination service and to;
- 3. Do so in a cost effective manner;

As shown by the Departments experience with APCO-AFC³, allowing a single point of contact which consists of a private corporation to have a monopoly on frequency coordination is not in the best interest of public safety.

The Department finds this method to be costly and to provide an avenue for special interests to impact or delay licensing issues.

As noted, the Department is implementing a shared system at 800 MHZ and therefore is required to use the services of a single coordinator, presently APCO-AFC. To date, NDOT has been operationally and economically impacted by APCO's opposition to the NDOT shared system. Because of unwarranted delays which have included requests by APCO-AFC to the FCC to freeze NDOT applications, the Department has been required to seek relief from the FCC and request assistance from the Nevada Attorney General to stop interference by APCO, a private non-profit corporation. As has been documented, APCO has not been representative of the governmental agencies implementing this system, has not provided non-discriminatory service, has been costly, and as mentioned, negatively impacted the Department both economically and operationally.

³Reference requests by the state and responses by FCC and Nv. Attorney General for assistance regarding frequency applications sent to APCO.

In review of technologies which provide common frequency data bases which can allow existing representative coordination bodies to concurrently work in shared pools such as the public safety UHF category for coordination and licensing. When coupled with technologies such as INTERNET, we know that technology can allow for multiple entities to provide and accomplish the technical requirements necessary for proper frequency coordination and do so in a distributed fashion as compared to centralized methods such as a single point of contact. Issues and arguments regarding frequency coordination now reduce to the cost for the user to obtain coordination along with providing several avenues to accomplish the frequency coordination, should a coordination service not be providing proper response or support.

It is the Department's conclusion that if present methods of frequency coordination continues, users should be provided multiple avenues to achieve frequency coordination. Expanding on this issue, the existing representative coordination bodies should be allowed to coordinate any service pool of frequencies similar to the UHF Public Safety band. This will provide a user the option of obtaining frequency coordination from multiple services which will cause the process to be competitive based on cost and service in lieu of being required to obtain service from a single provider. We also agree with the ability to place systems in operation upon approval from the coordinating body.